BIOLOGY OF *OMOBRANCHUS PUNCTATUS* (BLENNIIDAE) ON ROCKY SHORES IN KUWAIT

by

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ABSTRACT. - From July 1984 to June 1985, ecological and biological studies were carried out on the blenny *Omobranchus punctatus* which inhabits rocky areas of the intertidal zone in Kuwait. Mean water temperatures ranged between 13.6° C and 26.9° C and salinity between 37.1‰ and 44.9‰. The blennies were aged using otoliths and the population consisted of 1-4 year old fish. Gonad development was divided into five maturity stages; immature, maturing, mature, ripe and spent. Both males and females first became ripe during their second year. The peak in gonadosomatic index was in April for females and May for males. Although *O. punctatus* takes a wide variety of prey, it is mainly opportunistic and predominantly feeds on algae.

RÉSUMÉ. - L'écologie et la biologie d'une blennie, *Omobranchus punctatus*, ont été étudiées de juillet 1984 à juin 1985 pour une population vivant dans les régions rocheuses de la zone intertidale du Koweit. Les températures mensuelles moyennes de l'eau variaient entre 13,6°C et 26,9°C et le degré de salinité de 37,1‰ à 44,9‰. L'âge a été déterminé par otolithométrie. La population était composée de poissons âgés de 1 à 4 ans. Le développement des gonades a été divisé en 5 stades de maturité: immature, en maturation, mature, mûr et dépassé. Les mâles et les femelles n'arrivent à maturité que dans leur seconde année. Le maximum de l'indice gonadosomatique est atteint en avril pour les femelles et en mai pour les mâles. Alors que *O. punctatus* peut attraper une grande variété de proies, elle est essentiellement opportuniste et se nourrit principalement d'algues.

Key-words. - Blenniidae, *Omobranchus punctatus*, Kuwait, ISW, Age determination, Gonadosomatic index, Feeding.

Most biological studies on blennies have been made on temperate and particularly Atlantic species whilst few have dealt with tropical or Indo-Pacific species (Gibson, 1982). Although the genus *Omobranchus* contains the largest number of species of the seven genera in the Omobranchini tribe of the Blenniidae, little is known of the general biology of this genus (Springer and Gomon, 1975). This is probably a result of their Indo-Pacific distribution where little other than taxonomic studies are undertaken (Springer and Gomon, 1975). Being a common inhabitant of tropical and subtropical rocky intertidal shores, *Omobranchus punctatus* (Valenciennes) is a suitable subject with which to attempt to redress this imbalance as it is found both in the Caribbean Sea and in the Indo-west Pacific (Springer, 1972). This paper reports the life history of *O. punctatus* on the rocky shores of Kuwait.

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MATERIALS AND METHODS

Three species of *Omobranchus* are known from the intertidal zone of the Arabian Gulf: *Omobranchus fasciolatus* (Valenciennes), *O. mekranensis* Regan and *O. punctatus*, the latter two of which are sympatric. *O. punctatus* is the commonest species encountered (Relyea, 1981). The intertidal habitat of these fish is predominantly sandstone rock substrate which is typical of Kuwait's rocky shores (Jones, 1986) and they are found both beneath and within cavities of rocks. Fish were collected each month during the period from July 1984 to June 1985 from two rocky shores at sites 30 km apart. These were Shuwaikh Port (29° 21.5′N, 47° 55.5′E) and Al-Bida (29° 17.0′N, 48° 04.4′E). Fishes were caught from the lower eulittoral zone and transported to the laboratory in iced water for examination. Total length was measured to the nearest 0.1 cm and weight to the nearest 0.001 g. The gonads were removed, weighed to the nearest 0.001 g, and the gonadosomatic index (gonad wet weight as a percentage of body wet weight) was calculated. Additionally the gonads' state of maturity was assessed following a modified classification based on those of Jillet (1968) for females and Qasim (1957a) and Jillet (1968) for males. The following categories were recognized:

Females

Stage I Immature. Ovaries small, ribbon-like and transparent. The oocytes were microscopic and could only be recognized under magnification.

Stage II Maturing. The ovaries were slightly swollen and translucent. They occupied half the length of the body cavity and contained microscopic oocytes.

Stage III Mature. Ovaries occupied half the length of the body cavity. Oocytes appeared granular to the naked eye.

Stage IV Ripe. Ovaries were swollen and occupied most of the body cavity. The ova were larger, opaque and bright yellow in colour.

Stage V Spent. Ovaries were flaccid and few ova remained.

Males

Stage I Immature. Testes were transparent and very small.

Stage II Maturing. Testes were larger than in Stage I but white and translucent.

Stage III Mature. Testes were much larger occupying almost three-quarters of the length of the body cavity.

Stage IV Ripe. Testes were white in colour and opaque, and their size was the same as in Stage III.

Stage V Spent. Testes were flaccid and grey in colour although they were similar in size to those of Stage IV.

Age was determined from the otoliths following the conventions used by Qasim (1957a). Finally, following Sarker *et al.* (1980), an analysis of the gut content of 224 fish was undertaken. For all months but the first, the frequency of occurrence was determined for a minimum of 15 fish each month.

Several environmental parameters were recorded from 20 rock habitats each month and included air temperature (5 cm above rocks), sand temperature beneath the rocks, and water temperature of pools in which the rocks were situated. Dissolved O_2 levels were also recorded and water samples were collected for laboratory determination of salinity. At the same time rock crevices were examined for the presence of the blennies' yellow egg masses.

RESULTS

Kuwait is a semi-tropical region subjected to air temperatures which range from 0°C to 55°C annually (Al-Kulaib, 1984) and sea temperature from 13°C to 32°C (Houde *et al.*, 1986). Figure 1 shows the mean monthly air, water, and sand temperatures of the blennies' habitat together with salinity and O_2 concentration

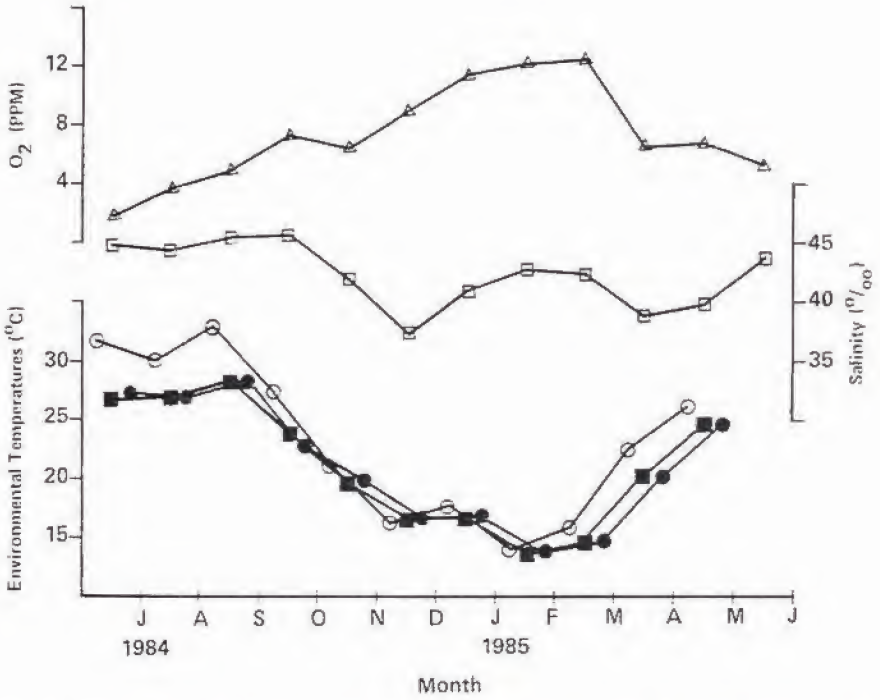

Fig. 1. - Mean of air, sea water and sand temperatures, salinity and dissolved oxygen of the microhabitat of *O. punctatus*. o = Air temperature; ■ = Sea water temperature; • = Sand temperature; □ = Salinity; Δ = Dissolved oxygen.

levels. Generally, temperature and salinity were highest in summer and lowest in winter, while the amount of dissolved O_2 showed a different trend, being highest in spring.

A total of 569 *O. punctatus* ranging from 21 mm to 102 mm total length were examined during the course of this study and were used to calculate a length-weight relationship of the form $W = aL^b$, where W = total weight in g, and L = total length in cm. This was found to be $W = 126.5L^{2.927}$
$r^2 = 0.9596$, df = 529. $p < 0.0001$ for log transformed linear regression.

Males and females had different mean total lengths at different ages with males attaining a significantly greater length than females at age 1+ (males 5.26 cm, SD 1.35; females 4.70 cm, SD 0.92, df 321, $t = 4.17$, $p < 0.001$), 2+ (6.88 cm, SD 1.38; 5.86 cm, SD 0.84; df 103, $t = 4.51$, $p < 0.001$), but not at age 3+ (7.26 cm, SD 1.45; 6.78 cm, SD 0.74; df 16, $t = 1.32$, $p > 0.2$). There was considerable overlap in the lengths of fishes in each age group (Fig. 2), and there were no clear cut size differences between age groups. This is more apparent in older fish where size increments were much reduced. For example the two largest (10.2 cm) fish were 2+ and 3+ males. Similarly the oldest (4+) individuals were males of 9 cm and 9.1 cm total length.

The Von Bertalanffy growth equation expressing the growth in length of female *O. punctatus* is: $Lt = 10.25(1-e^{-k(t+1.62)})$.
and that for males is: $Lt = 9.71(1-e^{-k(t+0.77)})$.

Neither growth curve reached a plateau indicating that there may be larger individuals.

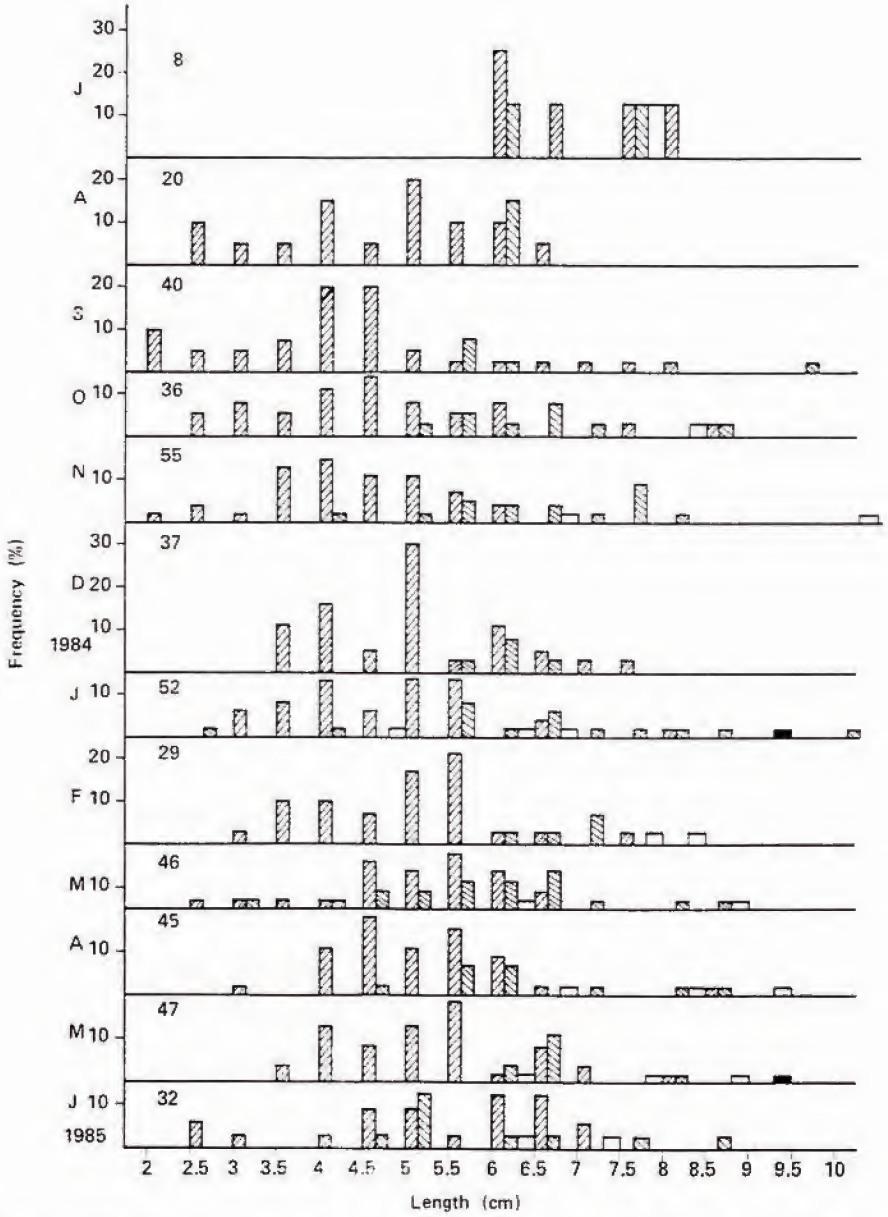

Fig. 2. - The total number of *O. punctatus* aged in each month together with the size frequency distribution of the 1^+ to 4^+ age groups. ▨ = 1^+; ▩ = 2^+; □ = 3^+; ■ = 4^+. Sample sizes are indicated on the left.

The size frequency distribution shows that the smallest fish were recruited to the population at the end of summer and most of the fishes in winter are of the age 1 + and more than 3 cm in length.

530 individuals could be sexed and classified according to the maturity scheme. Of these, 293 were males producing a male biased sex ratio of 1:1.24 (chi-

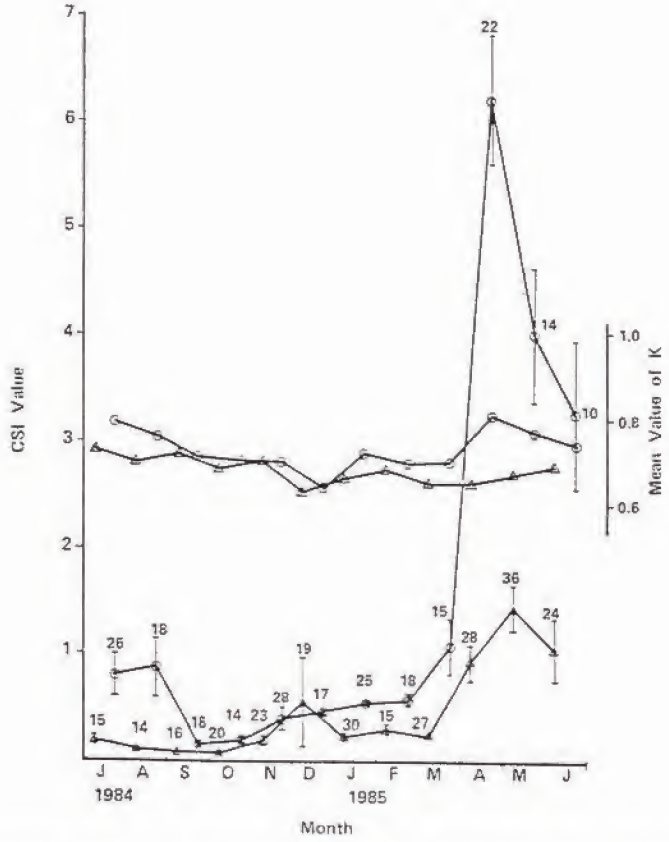

Fig. 3. - Seasonal variation in the condition factor K and gonadosomatic index (GSI) of *O. punctatus* including numbers and standard errors. o——o = female; Δ——Δ = male.

sq.= 6, df= 1, p< 0.01). The seasonal changes in the GSI indicate that *O. punctatus* breeds during the period March to August with the peak occurring during April to June (Fig. 3). Egg masses were present between April and June. The seasonal changes in gonad condition confirm this. Stage I (immature), II (maturing) and III (mature) individuals can be found at most times of the year, but Stage IV (ripe) and V (spent) individuals largely occur between February and June, with the males becoming ripe before the females (Fig. 4). The condition factor in females increased from February to April coinciding with the time of ripeness whilst in males it occurred in February (Fig. 3).

The major food items of *O. punctatus* include algae, diatoms, and various crustacea (Fig. 5). Additionally Foraminifera, fungal hyphae, Porifera, and some inanimate materials were also found and occurred occasionally, but stones or small pebbles were always found in the guts. Since fragments of shells, glass and wood were also found it is assumed that all these inanimate objects were taken accidentally during feeding. Generally about 20% of the guts examined each month were empty, but this rose to a maximum of 60% in December and thereafter decreased during the spring and reached minimum (0%) during May-July (Fig. 6). To see if there was any change in diet with size the food intake of small (2.5-2.9 cm), medium (5.0-5.4 cm) and large (7.5-7.9 cm) fish were compared, but no significant differences in diet were found.

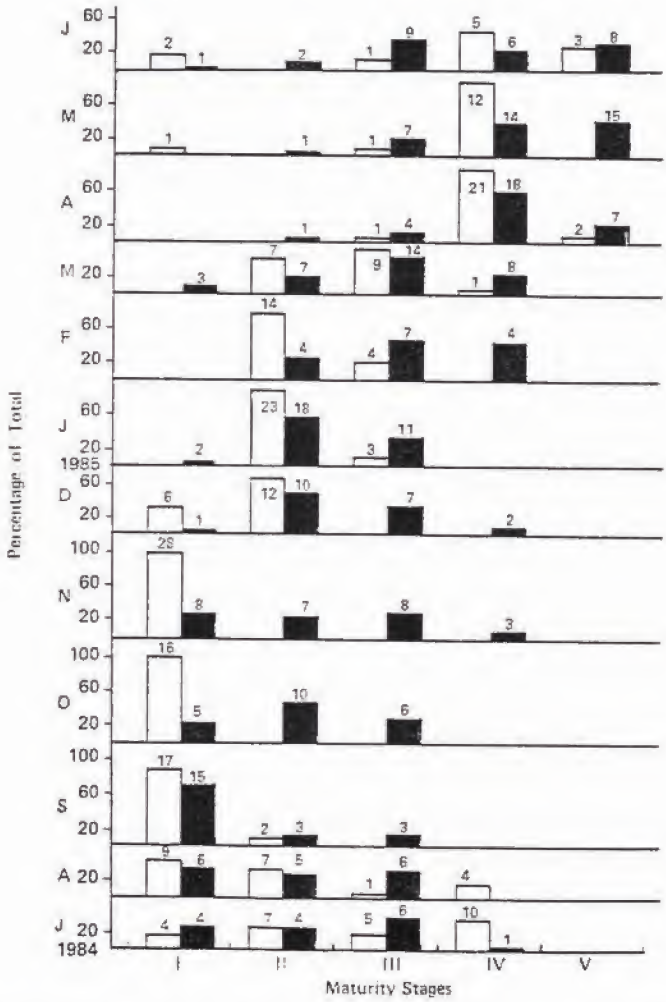

Fig. 4. - The seasonal changes in gonad condition of *O. punctatus*. The histograms show the percentage of fish at each of the five stages of maturity. I = immature; II = maturing; III = mature; IV = ripe; V = spent. Number of individuals are shown above each histogram. □ = female; ■ = male.

DISCUSSION

In Kuwait temperature is likely to be the most important environmental variable for *O. punctatus*. Oxygen and salinity levels are not extreme and this species can tolerate much lower salinity (McCosker and Dawson, 1975). However, the temperature regimes *O. punctatus* in Kuwait are exposed to are some of the highest experienced by intertidal blennies (Gibson, 1969).

O. punctatus is a small blenny and, as Qasim (1957a) reported for *Blennius pholis* Linnaeus and Fives (1980) for *Coryphoblennius galerita* (Linnaeus), there are no clear cut age-group size differences. One accurate way to age these fish, therefore, is by otolith readings. The overlap in length of age groups has been attributed to an extended breeding season (Jillet, 1968) and, specifically in blennies,

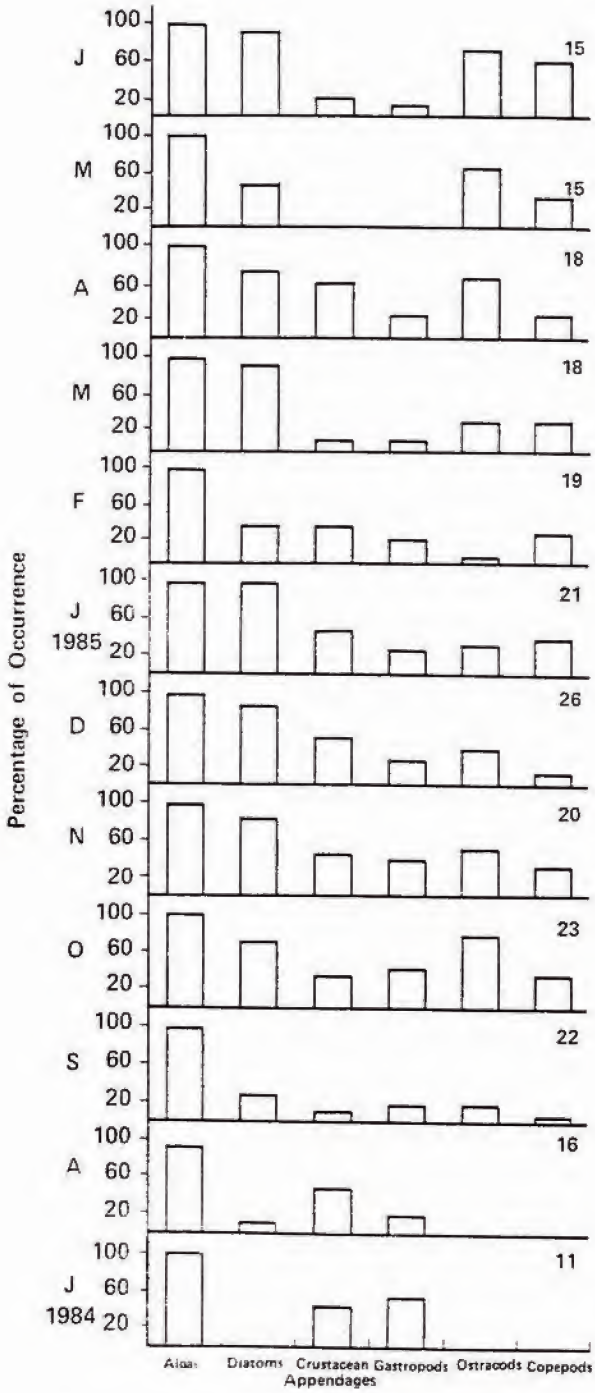

Fig. 5. - The percentage of occurrence of the common food items in *O. punctatus*. *N* values are present on the right.

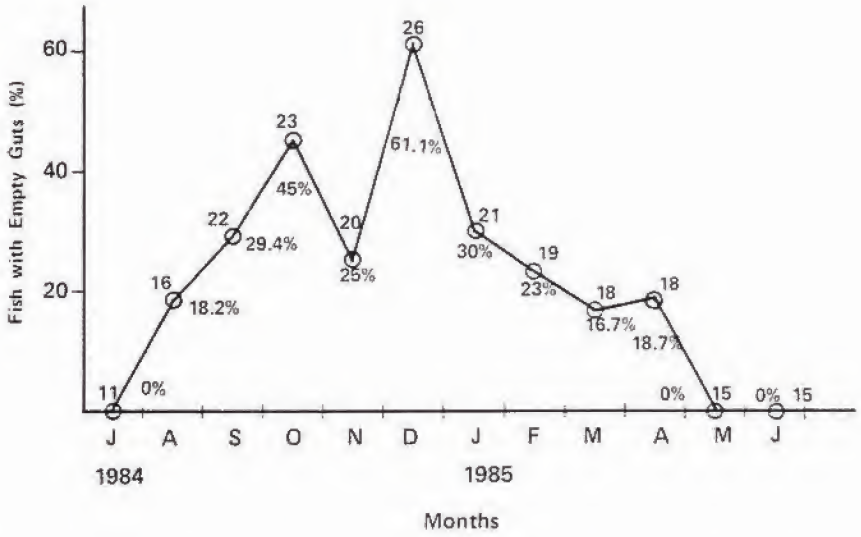

Fig. 6. - Seasonal variation in percentage of empty guts. Sample sizes are indicated above and percentages below.

to the fact that most growth occurs early in life (Qasim, 1957a) and to large variations in growth rates (Eyberg, 1984). In *O. punctatus* most growth occurs during the first two years as in other blennies (Dunne and Byrne, 1979; Dotsu and Moriuchi, 1980). The absence of fish smaller than 2 cm from the present collections suggests that they may be sublittoral.

In comparison with species from lower latitudes, Qasim (1957b) found that species in British waters that lived further north had shorter breeding seasons as an adaptation to provide optimun conditions of food and temperature. The relatively short breeding season of *O. punctatus* as compared with other blennies (Qasim, 1957a; Peters, 1981; Eyberg, 1984) may also be related to environmental conditions since it is comparable with other blennies living at the same latitude (Shiogaki and Dotsu, 1973; Dotsu and Oota, 1973; Balboutin and Perez, 1979). The duration of the breeding season in these species is probably constrained by the temperature extremes. Furthermore, the early maturity of *O. punctatus* is not uncommon in blennies (Dotsu and Oota, 1973; Dunne and Byrne, 1979; Eyberg, 1984).

The diet of *O. punctatus* is typical of many blennies (Gibson, 1968, 1982), but was noticeably deficient in such items as Isopods, Cirripedia, Polychaetes, and Echinoidea all of which can be found in the fishes habitat (Jones, 1986). Although no quantitative survey of the seasonal availability of prey was undertaken, it seems likely that *O. punctatus* is simply an opportunistic feeder taking food items as they became available. Algae was available all the year and blooms in the spring (Fadeel *et al.*, 1987; Al-Hassan and Jones, 1989). During spring only algae were found in the intestines; at other times diatoms, gastropods and crustacean appendages comprised a greater proportion of the diet. Like *Blennius cristatus* (Smith, 1974) and *Omobranchus loxozonus* (Jordan and Starks) (Dotsu and Oota, 1973), *O. punctatus* probably is a selective but omnivorous grazer on the surface of rocks.

Acknowledgements. - We thank J. Wright, K. Carpenter and two anonymous referees for their comments on the manuscript.

REFERENCES

AL-HASSAN R.H. & W.E. JONES, 1989. - Marine algal flora and sea grasses of the coast of Kuwait. *J. Univ. Kuwait*, 16: 289-342.

AL-KULAIB A.A., 1984. - The Climate of Kuwait. Meteorological Department, Directorate General of Civil Aviation, Kuwait. 82 pp.

BALBOUTIN F. & R. PEREZ, 1979. - Modalidad de postura, huevos y estados larvales de *Hypsoblennius sordidus* (Bennett) en la bahia de Valparaiso (Blenniidae: Perciformes). *Rev. Biol. Mar. Dept. Oceanol. Univ. Chile*, 16: 311-318.

DOTSU Y. & S. MORIUCHI, 1980. - The life history of the blenniid fish *Blennius yatabei* Jordan et Snyder. *Bull. Fac. Fish. Nagasaki Univ.*, 49: 17-24

DOTSU Y. & T. OOTA, 1973. - The life history of the blenniid fish, *Omobranchus loxozonus*. *Bull. Fac. Fish Nagasaki Univ.*, 36: 13-22.

DUNNE J. & P. BYRNE, 1979. - Notes on the biology of the Tompot blenny, *Blennius gattorugine* Brunnich. *Irish Nat. J.*, 19: 414-418.

EYBERG I., 1984. - The biology of *Parablennius cornutus* (L.) and *Scartella emarginata* (Günther) (Teleostei: Blenniidae) on a Natal Reef. *Invest. Rep. Oceanogr. Inst.*, 54: 1-16.

FADEEL A.A., METWALLI A. & F.A. AL HOUTY, 1987. - The effect of seasonal variation in temperature and light intensity on the nitrogenous contents in four species of the Chlorophyceae of Kuwait. *Dirasat*, 12: 107-118.

FIVES J.M., 1980. - An account of the eggs and developmental stages of Montagu's blenny, *Coryphoblennius galerita* (L.) with notes on the reproductive behaviour of the adults. *J. mar. biol. Assoc. UK.*, 60: 749-757.

GIBSON R.N., 1968. - The food and feeding relationships of littoral fish in the Banyuls region. *Vie Milieu*, 19: 447-456.

GIBSON R.N., 1969. - The biology and behaviour of littoral fish. *Oceanogr. Mar. Biol. Ann. Rev.*, 7: 367-410.

GIBSON R.N. 1982. - Recent studies on the biology of intertidal fishes. *Oceanogr. Mar. Biol. Ann. Rev.*, 20: 363-414.

HOUDE E.D., ALMATAR S., LEAK J.C. & C.E. DOWD, 1986. - Ichthyoplankton abundance and diversity in the western Arabian Gulf. *Kuwait Bull. Mar. Sci.*, 8: 107-393.

JILLET J.B., 1968. - The biology of *Acanthoclinus quadridactylus* (Bloch and Schneider) (Teleostei-Blennioidea). II - Breeding and development. *Aust. J. Mar. Freshwat. Res.*, 19: 9-18.

JONES D.A., 1986. - A Field Guide to the Sea Shores of Kuwait and the Arabian Gulf. Kuwait, University of Kuwait, 192 pp.

MCCOSKER J.E. & C.E. DAWSON, 1975. - Biotic passage through the Panama Canal, with particular reference to fishes. *Mar. Biol.*, 30: 343-351.

PETERS K.M., 1981. - Reproductive biology and developmental osteology of the Florida Blenny, *Chasmodes saburrae* (Perciformes: Blenniidae). *North-east Gulf Sci.*, 4: 79-98.

QASIM S.Z., 1957a. - The biology of *Blennius pholis* L. (Teleostei). *Proc. Zool. Soc. Lond.*, 128: 161-208.

QASIM S.Z., 1957b. - Time and duration of the spawning season in some marine teleosts in relation to their distribution. *J. Cons. int. Explor. Mer*, 21: 144-155.

RELYEA K., 1981. - Inshore Fishes of the Arabian Gulf. London, Allen and Unwin, 149 pp.

SARKER A.L., AL-DAHAM N.K. & M.N. BHATTI 1980. - Food habits of the mudskipper *Pseudapocryptes dentatus* (Val.). *J. Fish Biol.*, 17: 635-639.

SHIOGAKI M. & Y. DOTSU, 1973. - The spawning behaviour of the Tripterygiid blenny, *Tripterygion etheostoma*. *Jap. J. Ichthyol.*, 20: 36-41.

SMITH R.L., 1974. - On the biology of *Blennius cristatus* with special reference to anal fin morphology. *Bull. Mar. Sci.*, 24: 595-605.

SPRINGER V.G., 1972. - Synopsis of the tribe Omobranchini with descriptions of three new genera and two new species (Pisces: Blenniidae). *Smithson. Contrib. Zool.*, 130: 1-31.

SPRINGER V.G & M.F. GOMON, 1975. - Revision of the blenniid fish genus *Omobranchus* with descriptions of three new species and notes on other species of the tribe Omobranchini. *Smithson. Contrib. Zool.*, 177: 1-135.

Reçu le 07.08.1989.
Accepté pour publication le 05.07.1990.